

## DESCRIPTION

### DISC CARTRIDGE

#### TECHNICAL FIELD

[0001] The present invention relates to a disc cartridge for storing a disklike information storage medium such as an optical disc or a magnetic disk therein in a rotatable state.

#### BACKGROUND ART

[0002] Various disc cartridges have been proposed so as to store disklike information storage media therein.

[0003] For example, Patent Document No. 1 discloses a disc cartridge in which a disklike storage medium having a single or double information storage sides (which will be referred to herein as a "disc" simply) is completely enclosed in a disc storage space. The disc storage space is defined inside a cartridge body that is made up of upper and lower halves. The cartridge body has chucking windows and a head window. The chucking windows allow the turntable of a spindle motor and a clamper to chuck a disc inserted, while the head window

allows a head to read and/or write information from/on the disc. These windows form one continuous window. Accordingly, to prevent dust from entering the cartridge body and to prevent the disc from being soiled with finger marks, a shutter is provided for these windows.

Patent Document No. 1: Japanese Patent Application Laid-Open Publication No. 9-153264

Patent Document No. 2: Pamphlet of PCT International Application Publication No. WO 97/11463

### *Disclosure of the Invention*

#### *Problems to be Solved by the Invention*

[0004] A disc cartridge having such a structure, however, is supposed to be subjected to read and write operations by inserting a disc, which is still stored in the disc cartridge, into a disc drive. That is why the disc storage space, defined between the upper and lower halves, should be thick enough to cope with the expected flutter or warp of the disc being rotated and an error that may occur in positioning the cartridge in the disc drive. Thus, the cartridge body thereof

must be thick, which is a problem.

[0005] Also, the lower half is provided with a window for the turntable of the spindle motor and a head window, while the upper half is provided with another window for the clamper. Thus, to close these three windows up at a time, the shutter needs to be formed in a U-shape that covers both the upper and lower halves alike. However, a shutter of such a shape is not so cheap to make, thus raising the overall manufacturing cost of the disc cartridge.

[0006] Furthermore, when stored in a cartridge, an optical disc with no hub, e.g., a CD or a DVD, is normally not fixed, and movable freely, inside the cartridge. Accordingly, if the disc is shaken so much, the information storage side of the disc may get scratched. Or the disc may contact with the inner walls of the cartridge to stir up fine particles, which could be deposited on the disc.

[0007] Patent document No. 2 also discloses a disc cartridge for storing a disc in a cartridge body. In this disc cartridge, by turning an opening/closing lid, a disc inserting/removing window is opened, thus allowing the user to

remove the disc. However, it is not easy to unlock and open the opening/closing lid. In addition, the disc inserting/removing window is so narrow that the disc being inserted or removed may contact with portions surrounding the inserting/removing window and possibly get scratched.

#### **DISCLOSURE OF INVENTION**

[0008] In order to overcome the problems described above, an object of the present invention is to provide a disc cartridge that can hold a disc without moving it and that allows the user to remove the disc easily without scratching it.

[0009] A disc cartridge according to the present invention includes a cartridge body including a disc storage portion and a bottom window. The disc storage portion has a disc window and a bottom and stores a disc, having first and second sides, therein so that the disc is rotatable there and that the first side is exposed through the disc window. The bottom window is opened through the bottom of the disc storage portion so as to get the disc chucked externally and

to allow a head, which reads and/or writes information, to access the second side of the disc. The disc cartridge further includes: at least one shutter, provided on the bottom of the disc storage portion, for opening or shutting the bottom window; a rotational member, which is supported by the cartridge body so as to be rotatable therein and is interlocked with the shutter so as to open and close the shutter by rotating itself; a disc holding portion for interlocking with the shutter that is opening or closing so as to hold the disc onto either the shutter or the cartridge body when the shutter shuts the bottom window and to release the disc when the shutter opens the bottom window; and a stopper member, which is supported by the cartridge body so as to be movable from a position protruding into the disc window to a position not protruding into the disc window, or vice versa. The disc holding portion interlocks with the stopper member, and releases the disc when the stopper member has moved to the position not protruding into the disc window.

[0010] In one preferred embodiment, the stopper member and the rotational member interlock together, thereby interlocking

the disc holding portion and the stopper member with each other.

[0011] In another preferred embodiment, the disc cartridge further includes a coupling member for interlocking the stopper member and the rotational member together.

[0012] In another preferred embodiment, the coupling member includes first and second engaging portions to engage with the stopper member and the rotational member, respectively, and the second engaging portion contacts and engages with the rotational member while the stopper member is moving.

[0013] In another preferred embodiment, the first engaging portion of the coupling member is supported by the stopper member so as to be rotatable.

[0014] In another preferred embodiment, the coupling member is positioned such that the second engaging portion of the coupling member does not contact with the rotational member while the stopper member is protruding into the disc window.

[0015] In another preferred embodiment, the second

engaging portion of the coupling member has a pin portion, and the cartridge body has a groove portion, which fits with the pin portion to define a direction in which the second engaging portion moves.

[0016] In another preferred embodiment, the cartridge body has a removal history hole, which is cut through the cartridge body, and a columnar cap member, which covers the removal history hole at least partially and which is attached to, but readily removable from, the cartridge body. The stopper member has a hole to which the cap member is inserted.

[0017] In another preferred embodiment, the disc cartridge further includes a locking member for locking the rotational member onto the cartridge body while the shutter closes the bottom window.

[0018] In another preferred embodiment, the stopper member and the locking member interlock together so as to make the locking member unlock the rotational member by moving the stopper member.

[0019] In another preferred embodiment, the stopper member and the rotational member interlock together, thereby

interlocking the disc holding portion and the stopper member with each other.

[0020] In another preferred embodiment, the disc cartridge further includes a coupling member for interlocking the stopper member and the rotational member together.

[0021] In another preferred embodiment, the coupling member includes first and second engaging portions to engage with the stopper member and the rotational member, respectively, and the second engaging portion contacts and engages with the rotational member while the stopper member is moving.

[0022] In another preferred embodiment, the first engaging portion of the coupling member is supported by the stopper member so as to be rotatable.

[0023] In another preferred embodiment, the coupling member is positioned such that the second engaging portion of the coupling member does not contact with the rotational member while the stopper member is protruding into the disc window.

[0024] In another preferred embodiment, the second



engaging portion of the coupling member has a pin portion, and the cartridge body has a groove portion, which fits with the pin portion to define a direction in which the second engaging portion moves.

[0025] In another preferred embodiment, while the stopper member is not protruding into the disc window, the disc holding portion does not protrude into the disc window, either.

[0026] In another preferred embodiment, the stopper member either turns or slides with respect to the cartridge body, thereby taking the position protruding into the disc window or the position not protruding into the disc window.

[0027] In another preferred embodiment, the disc cartridge includes two shutters including the at least one shutter, and the disc holding portion is provided for each of the two shutters.

[0028] In another preferred embodiment, the disc holding portions hold the disc by pressing at least outer peripheral portions of the second side of the disc against the bottom of the disc storage portion.

[0029] In another preferred embodiment, the stopper member is provided so as to be attachable and removable to/from the cartridge body.

[0030] In another preferred embodiment, the locking member is provided so as to be attachable and removable to/from the cartridge body.

#### *Effects of the Invention*

[0031] According to the present invention, the disc holding portion can firmly hold the disc so as not to make the disc move inconstantly. Thus, even while the disc is being inserted into the disc cartridge, the disc never gets scratched. In addition, the stopper member interlocks with the disc holding portion such that the disc holding portion releases the disc while the stopper member is being moved so as not to protrude into the disc window. In this manner, the disc can be removed through the disc window without getting it scratched.

#### **BEST MODE FOR CARRYING OUT THE INVENTION**

## EMBODIMENT 1

[0032] Hereinafter, a first preferred embodiment of a disc cartridge according to the present invention will be described. First, the overall structure of this disc cartridge **301** will be outlined with reference to FIGS. **1** and **2**.

[0033] The disc cartridge **301** includes a cartridge lower shell **11**, a cartridge upper shell **12**, a first shutter **21**, a second shutter **22**, a stopper member **23**, a locking member **24**, a rotational member **25** and a coupling member **26**. These members may be made of a synthetic resin, for example. However, there is no need to make all of these members of the same material. Instead, best materials may be selected for these members in view of the mechanical strengths or appearance required for them.

[0034] The cartridge lower shell **11** has an inner lower surface **11u**. The inner lower surface **11u** has a chucking window **11c** and a head window **11h**. The chucking window **11c** allows a chucking member (e.g., a spindle motor for rotating the disc **100**) to enter the disc cartridge **301** externally. The

head window **11h** allows a head, which reads and/or writes information, to enter the disc cartridge **301** and access a target location on the disc **100**. The head window **11h** is continuous with the chucking window **11c** to form a bottom window, and also reaches one side surface of the cartridge lower shell **11**. Also, a recess **11r** is provided on another side surface of the cartridge lower shell **11**, which is adjacent to the side surface with the head window **11h**.

[0035] As will be described in detail later, the inner lower surface **11u** has two grooves **11e** and **11f** that receive the respective ends of raised portions **25e** and **25f** provided for the rotational member **25**. These grooves **11e** and **11f** preferably do not reach the bottom of the inner lower surface **11u**. The inner lower surface **11u** further has another groove **11m** to receive the pin portion **26p** of the coupling member **26**. The groove **11m** preferably does not reach the bottom of the inner lower surface **11u**, either. The inner lower surface **11u** further includes a pair of rotation shafts **11p** that fits with rotation holes **21a** and **22a** provided for the first and second shutters **21** and **22**, respectively. In this preferred embodiment,

the rotation holes **21a** and **22a** are opened through the first and second shutters **21** and **22** and rotation shafts **11p** are provided on the cartridge lower shell **11**. Alternatively, the rotation shafts may be provided on the first and second shutters **21** and **22** and rotation holes may be opened through the cartridge lower shell **11**. Also, the inner lower surface **11u** further has a removal history hole **11k** for checking if the disc has ever been removed and a cap member **11n** that closes the removal history hole **11k**. The cap member **11n** is connected to the removal history hole **11k** at a strength that is low enough to pull it off easily.

[0036] The cartridge upper shell **12** includes a circular disc window **12w**, which expands over the entire projection area of the disc **100**. The disc window **12w** is defined by a cylindrical side surface **12i**. The disc **100** can be inserted into, and removed from, the disc cartridge **301** through this disc window **12w**.

[0037] The cartridge upper and lower shells **12** and **11** are adhered, ultrasonic-welded or joined (e.g., screwed up) together around their outer periphery, thereby forming a

cartridge body. Also, the inner lower surface **11u** of the cartridge lower shell **11** and the side surface **12i** of the cartridge upper shell **12** together define a disc storage portion for storing the disc **100** therein.

[0038] In the disc storage portion, the space defined by the side surface **12i** is wide enough to allow the disc **100** to rotate freely therein without contacting with the side surface **12i**. The top of the disc storage portion is opened as the disc window **12w**, and the first side **100A** of the disc **100** stored in the disc storage portion is exposed entirely through the disc window **12w**. On the other hand, the second side **100B**, i.e., the information storage side of the disc **100**, faces the inner lower surface **11u**.

[0039] A stopper member **12s** is provided as an integral part of the upper surface **12d** of the cartridge upper shell **12** so as to expand into the window **12w**. The stopper member **12s** and another stopper member **23** (to be described later) are used to prevent the disc **100**, stored in the disc storage portion of the cartridge body, from dropping down through the disc window **12w**.

[0040] These stopper members **12s** and **23** are particularly effective when this disc cartridge is loaded into a vertically mounted disc drive. Optionally, three or more stopper members may be provided and/or each of the stopper members may be formed in any other shape or provided at any position other than that shown in FIG. 1.

[0041] By adopting such a structure, the cartridge **301** can be thinner than a conventional cartridge in which both sides of the disc are covered. In addition, the label side of the disc can be displayed through the disc window **12w** and the operator can check the contents of the disc that were printed on the label side (i.e., the first side) **100A**. Moreover, by displaying the design of the label side, the disc cartridge including the disc can also have a good design.

[0042] The first and second shutters **21** and **22** are provided on the inner lower surface **11u** of the cartridge lower shell **11**. When the disc **100** is stored in the disc cartridge **301**, the first and second shutters **21** and **22** are located between the information storage side (i.e., the second side) **100B** of the disc **100** and the inner lower surface **11u**. The first and

second shutters **21** and **22** have the rotation holes **21a** and **22a**, respectively, which are inserted into the rotation shafts **11p** of the cartridge lower shell **11**. Thus, the first and second shutters **21** and **22** rotate on the rotation shafts **11p**, thereby opening or shutting the head and chucking windows **11h** and **11c**. When the first and second shutters **21** and **22** are opened, the second side **100B** of the disc **100** is partially exposed through the head window **100h**.

[0043] The first and second shutters **21** and **22** are provided with notches so as to define a hole **20h** in a region that overlaps with the center hole **100h** of the disc **100** stored in the cartridge body when the first and second shutters **21** and **22** close the bottom window. The notches of the first and second shutters **21** and **22** are surrounded with raised portions **21w** and **22w**, respectively. When the first and second shutters **21** and **22** are closed, these raised portions **21w** and **22w** are in close contact with each other, thereby forming a raised portion **20w** that is adjacent to the inner circumference of the center hole **100h** of the disc **100**. The raised portion **20w** prevents dust from reaching the information storage side **100B**



of the disc **100** by way of the center hole **100h**. Furthermore, the raised portions **21w** and **22w** have three protrusions **20p** beside the hole **20h**. That is to say, the top of the protrusions **20p** is higher than that of the raised portions **21w** and **22w**. While the first and second shutters **21** and **22** are opening or closing, the protrusions **20p** contact with a non-information storage area of the second side **100B** (i.e., the information storage side) of the disc **100**, thereby lifting the disc upward. In this manner, it is possible to prevent the raised portion **20w** from contacting with, and scratching, the information storage area of the second side **100B** while the shutters are opening or closing.

[0044] Also, the first shutter **21** includes a disc holding portion **21d**, while the second shutter **22** includes disc holding portions **22c** and **22d**. Each of these disc holding portions has a downwardly tapered slope, which faces the bottom of the disc storage portion. When the first and second shutters **21** and **22** are closed, the disc holding portions **21d**, **22c** and **22d** protrude into the disc storage portion and their slopes contact with the outer periphery of the first side **100A** of the

disc **100**. In this manner, the disc **100** can be held or fixed firmly by pressing at least a portion of the disc **100** around the outer periphery of the second side **100B** toward the bottom of the disc holding portions.

[0045] Another raised portion **21c** is provided at the end of the first shutter **21**. While the first and second shutters **21** and **22** are closed, the raised portion **21c** prevents the side surface of the disc **100** from being exposed through the chucking window **11h** that reaches the side surface of the cartridge lower shell **11**.

[0046] As will be described in detail later, the first and second shutters **21** and **22** include guide grooves **21s** and **22s** that respectively engage with the raised portions **25e** and **25f** of the rotational member **25**. The guide grooves **21s** and **22s** extend vertically through the first and second shutters **21** and **22**, respectively, so that the raised portions **25e** and **25f** of the rotational member **25** can reach the bottom.

[0047] The rotational member **25** includes a sidewall **25i** and a disc receiving portion **25a** that is connected to the bottom of the sidewall **25i**. The sidewall **25i** has a cylindrical shape

and has such a size as to surround the side surface of the disc 100 stored. The sidewall 25i is discontinued by three notches 25d, 25g and 25h. The disc receiving portion 25a has a flat ring shape including a notch 25c. As the rotational member 25 rotates, the first and second shutters 21 and 22 are opened. At this time, the rotational member 25 has such an angle of rotation as to match the notch 25c with the head window 11h.

[0048] While the first and second shutters 21 and 22 are closed, the disc holding portions 21d, 22d, 21c and 22c protrude through the notches 25g, 25h and 25d toward the disc receiving portion 25a, thereby holding the disc 100 thereon. Convex portions 25e and 25f, which protrude toward the cartridge lower shell 11, are provided on the lower surface of the disc receiving portion 25a. Furthermore, a recess 25s and a gear 25j, which interlock with the shutter opening/closing mechanism of a disc drive, are provided on the outer side surface of the sidewall 25i. The recess 25s and the gear 25j are exposed through a window, which is opened at the bottom of a side recess 11r, according to the angle of rotation of the

rotational member 25. Also, outside of the sidewall 25i, provided are an engaging window 25k to fit with the locking end portion 24k of the locking member 24 to be described later and a recess 25m to engage with the raised portion 26a of the coupling member 26 to be described later.

[0049] The locking member 24 locks the rotational member 25 up such that the rotational member 25 will not rotate. The rotation hole 24h of the locking member 24 is inserted into the rotation shaft 11s provided on the cartridge lower shell 11 such that the locking member 24 is supported on the rotation shaft 11s so as to be rotatable freely. Also, a spring portion 24b contacts with the inner side surface of the cartridge lower shell 11, thereby applying elastic force to the locking end portion 24k toward the engaging window 25k of the rotational member 25. Furthermore, an unlocking portion 24s is exposed on a side surface of the disc cartridge 301. To unlock the rotational member 25 and make it rotatable, a drive mechanism may press the unlocking portion 24s. By pressing the unlocking portion 24s, the locking member 24 turns around the rotation hole 24h and the locking end portion

**24k** is disengaged from the engaging window **25k**, thereby getting the rotational member **25** unlocked. In this manner, the rotational member **25** is locked by the locking member **24** so as not to rotate. As a result, the first and second shutters **21** and **22**, interlocked with the rotational member **25**, are also locked while being closed.

[0050] In this preferred embodiment, the locking member **24** locks the rotational member **25** up. Alternatively, the locking member **24** may lock one or both of the first and second shutters **21** and **22**. As another alternative, a locking member having a removable structure may be provided for the cartridge body **301** and may be removed so as to unlock the rotational member **25** or the first and/or second shutter(s) **21** and/or **22**.

[0051] The stopper member **23** is provided near a side surface of the cartridge body, consisting of the cartridge upper and lower shells **12** and **11**, so as to face another side surface of the cartridge body with the head window **11h**. A rotation shaft **23a** is provided near one end of the longer side of the stopper member **23**, while the other end thereof includes a hooking portion **23d** with a spring portion **23e**. A hole **23h**,

to which a cap member **11n** is inserted, is also provided.

[0052] The cartridge upper shell **12** has a rotation hole **12m** to receive the rotation shaft **23a** of the stopper member **23**. When the rotation shaft **23a** is inserted into the rotation hole **12m**, the shaft **23** is hooked and secured by a hooking portion provided at the end of the rotation shaft **23a**. The cartridge lower shell **11** further has a retaining wall **11d** for receiving the hooking portion **23d**. The cartridge upper shell **12** further has a recessed portion **12k** so that the upper surface of the stopper member **23** is leveled with the upper surface **12d** of the cartridge upper shell **12** when the stopper member **23** is attached to the cartridge upper shell **12**. The rotation hole **12m** is provided in the recessed portion **12k**. While the stopper member **23** is protruding into the disc window **12w** and over the disc **100** stored, the hooking portion **23d** is engaged with the retaining wall **11d**, thereby fixing the stopper member **23** onto the cartridge body.

[0053] FIG. 2 illustrates the structure of a portion of the cartridge body near the removal history hole **11k**. As

described above, the removal history hole **11k** of the cartridge lower shell **11** is partially covered with the cap member **11n**. The cap member **11n** has a columnar shape and is connected to the cartridge lower shell **11** with a thin connecting portion **11q** that surrounds the removal history hole **11k**. The connecting portion **11q** has a small thickness and a narrow width. Accordingly, when the cap member **11n** is pressed down strongly in the direction pointed by the arrow **C**, the connecting portion **11q** is broken, thereby removing the cap member **11n** from the cartridge body. In other words, the cap member **11n** is attached to the cartridge body with the connecting portion **11q** so as to be readily removable.

[0054] As shown in FIG. 2, the center of the removal history hole **11k** matches that of the hole **23h** of the stopper member **23**, and a part of the cap member **11n** is inserted into the hole **23h**. That is why as long as the cap member **11n** is connected to the cartridge lower shell **11** of the cartridge body with the connecting portion **11q**, the cap member **11n** prevents the stopper member **23** from moving.

[0055] Referring back to FIG. 1, arranged is the coupling member 26 between the stopper member 23 and the cartridge lower shell 11. A rotation hole 26h is provided at one end of the coupling member 26, which functions as a first engaging portion. If the rotation hole 26h is inserted into, and fixed on, the rotation shaft 23n provided on the back surface of the stopper member 23, then the coupling member 26 can turn freely with respect to the stopper member without being disengaged from the stopper member. At the other end of the coupling member 26, which functions as a second engaging portion, provided are a raised portion 26a and a pin portion 26p. The raised portion 26a fits in with a recess 25m provided on the side surface of the rotational member 25, thereby rotating the rotational member 25. On the other hand, the pin portion 26p fits into, and moves along, a groove portion 11m cut through the cartridge lower shell 11.

[0056] The respective members of the disc cartridge 301 are assembled together so as to maintain the vertical positional relationship shown in FIG. 1. As a result, the cartridge lower and upper shells 11 and 12 are joined together



so that the first and second shutters **21** and **22** are arranged on the cartridge lower shell **11** and that the rotational member **25** is located over the shutters **21** and **22**. In such a state, the disc **100** is inserted through the disc window **12w** and finally the stopper member **23** is attached, thereby completing the disc cartridge **301**.

[0057] Hereinafter, the operations of inserting and removing the disc **100** into/from the disc cartridge **301** will be described in detail with reference to FIGS. **3** through **6**.

[0058] FIGS. **3** and **5** illustrate a state where the stopper member **23** partially protrudes over the disc window **12w** to prevent the disc **100** from dropping down through the disc window **12w**. On the other hand, FIGS. **4** and **6** illustrate a state where the stopper member **23** does not protrude over the disc window **12**. Among these drawings, no disc **100** is illustrated in FIGS. **3** and **4** to show the structure of the disc cartridge **301** clearly.

[0059] In FIG. **3**, the first and second shutters **21** and **22** are closed, which state is maintained by the rotational member **25** and the locking member **24**. At this point in time, the disc

100 is held and fixed by the disc holding portions 21d, 22d and 22c protruding into the disc storage portion as shown in FIG. 5. More specifically, the slopes of the disc holding portions 21d, 22d and 22c contact with the outer periphery of the disc 100. In this manner, the disc holding portions 21d, 22d and 22c hold the disc 100 with the center of the disc 100 slightly offset from that of the disc storage portion such that while the first and second shutters 21 and 22 are closed, the outer side surface of the disc 100 contacts with the sidewall 12i of the disc storage portion where the notch 25c of the rotational member 25 is located. At the same time, by bringing the slopes of the disc holding portions 21d, 22d and 22c into contact with the outer periphery of the disc 100, the disc 100 is pressed against the bottom of the disc storage portion. In this manner, the disc 100 is fixed onto the first and second shutters 21 and 22 and to the body of the disc cartridge. In addition, by bringing the outer and inner peripheries of the information storage side 100B of the disc into contact with the disc receiving portion 25a of the rotational member 25 and the raised portion 20w of the

shutters, the information storage area of the information storage side **100B** is sealed such that no dust will be deposited on the information storage area.

[0060] A portion of the stopper member **23** is protruding into the disc window **12w** and is located over the disc **100**. Even so, the disc **100** can still be held and fixed because the first and second shutters **21** and **22** with the disc holding portions **21d**, **22d** and **22c** are kept closed.

[0061] First, it will be described with reference to FIG. 3 why the first and second shutters **21** and **22** can be kept closed. The turning of the first shutter **21** is regulated by the rotational member **25** with the raised portion **25e** of the rotational member **25** fitted into a guide groove **21s**. In the same way, the turning of the second shutter **22** is regulated by the rotational member **25** with the raised portion **25f** of the rotational member **25** fitted into another guide groove **22s**. On the other hand, the rotational member **25** is also kept from rotating because the locking end portion **24k** of the locking member **24** fits in with the engaging window **25k** of the rotational member **25**. That is why as long as the locking end

portion **24k** fits in with the engaging window **25k**, the first and second shutters **21** and **22** can be kept closed.

[0062] Next, it will be described with respect to FIG. 3 again why the stopper member **23** can be kept protruding over the disc **100**. The stopper member **23** has the rotation shaft **23a** at one end thereof so as to turn freely, but is now kept from turning because the hooking portion **23d** at the other end thereof is engaged with the retaining wall **11d** of the cartridge lower shell **11**. In addition, the cap member **11n** of the cartridge lower shell **11** now fits in with the hole **23h** of the stopper member **23**, thereby keeping the stopper member **23** from turning, too. Consequently, while the hooking portion **23d** is engaged with the retaining wall **11d** and while the cap member **11n** fits in with the hole **23h**, the stopper member **23** can be kept protruding over the disc **100** as shown in FIG. 5.

[0063] Also, as long as the stopper member **23** is protruding over the disc **100**, the raised portion **26a** at the end of the coupling member **26** does not contact or fit with the recess **25m** of the rotational member **25**. That is why even if the disc cartridge **301** were inserted into a disc drive and if the disc

drive turned the rotational member **25** to open or close the shutters, the coupling member **26** would have no effects on the rotation operation of the rotational member **25**.

[0064] Next, the operation of removing the disc **100** from the disc cartridge **301** will be described. First, when the operator presses the cap member **11n** with the tip of a pen, for example, the cap member **11n** separates from the cartridge lower shell **11** (see FIG. 2). As a result, the removal history hole **11k** is now open and the cap member **11n** drops through the hole **23h** of the stopper member **23**.

[0065] And when the unlocking portion **24s** of the locking member **24** is pressed with a fingertip, for example, the locking member **24** starts to turn around the rotation hole **24h**, thereby disengaging the locking end portion **24k** from the engaging window **25k** of the rotational member **25**. Next, if the hooking portion **23d** of the stopper member **23** is pulled in the direction **B** while being bent in the direction **A** shown in FIG. 3, then the stopper member **23** is unlocked and is now free to turn. As the stopper member **23** turns in this manner, the coupling member **26** also starts to turn around the rotation

hole **26h**. In the meantime, the pin portion **26p** at the end of the coupling member **26** starts to move in the direction **A** along the groove portion **11m** of the cartridge lower shell **11**.

[0066] As the stopper member **23** further turns, the coupling member **26** also turns and the pin portion **26p** also goes farther in the direction **A**. As a result, the raised portion **26a** surrounding the pin portion **26p** gets engaged with the recess **25m** of the rotational member **25**. After that, as the stopper member **23** turns, the pin portion **26p** of the coupling member **26** moves along the groove portion **11m**, which substantially follows the track of the rotational member **25**, while the rotational member **25** rotates clockwise with the raised portion **26a** and the recess **25m** engaged together.

[0067] FIGS. **4** and **6** show a state where the stopper member **23** has turned fully. As the stopper member **23** turns, the rotational member **25** is rotated by way of the coupling member **26**, and then the first and second shutters **21** and **22** are turned by way of the rotational member **25**. As a result, the first and second shutters **21** and **22** are opened a little. By this point in time, the disc holding portions **21d** and **22d** have

moved to positions not protruding into the disc window **12w**.

[0068] As shown in FIG. 6, the stopper member **23** is no longer located over the disc **100**. Furthermore, the disc holding portions **21d** and **22d** are not protruding into the disc window **12w**, either. Thus, the disc **100** has been released and is not held anymore.

[0069] Then, the operator can remove the disc **100** from the disc cartridge **301** by gripping the disc **100** with a finger laid on the center hole **100h** thereof and lifting the edge of the disc **100** from around the stopper member **23** on the cartridge upper shell **12**.

[0070] As described above, unless the cap member **11n** is removed, the stopper member **23** cannot turn and the disc **100** cannot be removed, either. When the cap member **11n** is pushed out to remove the disc **100**, the removal history hole **11k** opens. Thus, it can be seen that as long as the removal history hole **11k** is closed, no disc **100** has ever been removed but the disc **100** originally stored when the disc cartridge **301** was manufactured is still stored there.

[0071] A disc drive to be loaded with this disc cartridge 301 senses the opened or closed state of this removal history hole 11k, thereby controlling the read or write operation in accordance with the result. For example, suppose the disc cartridge 301 manufactured should store a disc to be read from or written to in compliance with only a predetermined standard. The disc drive checks the state of the removal history hole of the disc cartridge 301 loaded. If the disc drive finds the removal history hole 11k closed, the disc drive recognizes the disc stored in the disc cartridge 301 as readable or writable in compliance with the predetermined standard. Then, the disc drive can quickly perform a read or write operation on the disc in compliance with that standard. On the other hand, if the disc drive finds the removal history hole 11k opened, the disc drive senses the disc stored in the disc cartridge as an unknown type. In that case, to recognize the type of the disc that is stored in the disc cartridge, the disc drive radiates a beam including various types of test information toward the disc first. Next, in accordance with the test results, the disc drive reads or writes information from/on the disc under



the best conditions.

[0072] Next, it will be described how to store the removed disc **100** in the cartridge **301** again. The operator grips the disc **100** with a finger laid on the center hole **100h** thereof and sets the disc **100** within the disc window **12w** by putting it under the stopper member **12s**. Thereafter, the operator turns the stopper member **23** to the original position, thereby getting the hooking portion **23d** and the retaining wall **11d** engaged with each other. In the meantime, the coupling member **26** turns the rotational member **25** counterclockwise and the rotational member **25** closes the first and second shutters **21** and **22** up. Synchronously, the locking member **24** is turned counterclockwise by the spring portion **24b**, thereby engaging the engaging window **25k** and the locking end portion **24k** with each other and regulating the rotation of the rotational member **25**. Consequently, when the first and second shutters **21** and **22** are closed, the disc holding portions **21d** and **22d** hold the disc **100** thereon.

[0073] According to this preferred embodiment, the disc **100** can be removed from the disc cartridge **301** just by

pressing the locking member **24** and turning the stopper member **23**. In this case, the stopper member **23** and the disc holding portions of the shutters interlock with each other by way of the coupling member **26** and the rotational member **25**. That is to say, while the stopper member **23** is being turned so as not to protrude into the disc window, the disc holding portions release the disc. As a result, the disc **100** can be removed through the disc window **12w** without getting scratched.

[0074] Also, in storing the removed disc **100** back in the disc cartridge **301** again, the disc **100** is introduced through the disc window **12w** into the cartridge body and the stopper member **23** is turned to its original position. In this manner, the disc **100** can be inserted into the disc cartridge **301** successfully. In this case, while the stopper member **23** is being turned so as to protrude into the disc window, the disc holding portions fix the disc **100**. That is why the disc does not get scratched, either, while being inserted into the disc cartridge. Furthermore, since the disc is fixed in the disc cartridge, the disc never moves inconstantly or stirs up fine particles in the cartridge.

## EMBODIMENT 2

[0075] Hereinafter, a second preferred embodiment of a disc cartridge according to the present invention will be described. The disc cartridge of this preferred embodiment also has a structure for increasing the handiness by making the disc removable more easily. However, this second preferred embodiment is quite different from the first preferred embodiment in the position of the stopper member and in that there is no need to press the locking member during the operation of removing the disc. Thus, these features will be described in detail. Each member of the second preferred embodiment, having the same function as the counterpart of the first preferred embodiment, is identified by the same reference numeral as that used for the first preferred embodiment.

[0076] FIG. 7 shows a state where the disc **100** is stored in the disc cartridge **302** of this preferred embodiment. FIG. 8 shows a state where the disc **100** is readily removable.

[0077] The stopper member **33** of this preferred embodiment

turns around the rotation hole **24h** of the locking member **24**. That is to say, the stopper member **23** of the first preferred embodiment is replaced with the stopper member **33** that is provided near the head window **11h** so as to selectively protrude into the disc window.

[0078] Hereinafter, it will be described how to remove the disc **100**. The operator disengages the engaging portion **33d** of the stopper member **33** from the disc cartridge **302**. And if the engaging portion **33d** is moved in the direction **A**, the stopper member **33** turns. As a result, the raised portion **33p** of the stopper member **33** contacts with the locking member **24**, thereby turning the locking member **24** in an unlocking direction. That is to say, the stopper member **33** and the locking member **24** interlock with each other. As the locking member **24** turns, the rotational member **25** is unlocked.

[0079] In the meantime, as the stopper member **33** turns, the rotational member **25** is turned clockwise by the coupling member **26**, and the first and second shutters **21** and **22** start to open themselves as the rotational member **25** turns as in the first preferred embodiment described above. Although the

coupling member 26 is provided at a different position from the first preferred embodiment, the coupling member 26 has the same structure as the counterpart of the first preferred embodiment. Also, portions of the stopper member 33 and rotational member 25 to interlock with the coupling member 26 have the same structures as the counterparts of the first preferred embodiment described above.

[0080] As shown in FIG. 8, the stopper member 33 that has turned fully no longer protrudes over the disc 100. At this point in time, the disc holding portions 21d and 22d do not protrude into the disc window 12w but are retracted from the disc window 12w. In this manner, the disc 100 is released. Then, as in the first preferred embodiment, the operator can remove the disc 100 from the disc cartridge 302 by gripping the disc 100 with a finger laid on the center hole 100h thereof and lifting the edge of the disc 100 from around the stopper member 33 on the cartridge upper shell 12.

[0081] Next, it will be described how to store the removed disc 100 in the cartridge 302 again. The operator grips the disc 100 with a finger laid on the center hole 100h thereof

and inserts the disc **100** into the disc storage portion through the disc window **12w** by putting it under the stopper member **12s**. Thereafter, when the operator turns the stopper member **33** to the original position, the disc is fixed by the hooking portion **33d**. In the meantime, the coupling member **26** turns the rotational member **25** counterclockwise and the rotational member **25** closes the first and second shutters **21** and **22** up. Synchronously, the locking member **24** is turned counterclockwise by the spring portion **24b**. When the first and second shutters **21** and **22** are closed, the locking member **24** gets interlocked with the rotational member **25**, thereby regulating the rotation of the rotational member **25**. And when the first and second shutters **21** and **22** are closed as a result of the rotation of the rotational member **25**, the disc holding portions **21d**, **22d** and **22c** protrude into the disc storage portion. Then, the outer periphery of the second side **100B** of the disc **100** is pressed against the bottom of the disc holding portions in the disc storage portion, thereby holding the disc **100** thereon.

[0082] According to this preferred embodiment, the disc **100**

can be removed from the disc cartridge 302 just by turning the stopper member 33. Also, in storing the removed disc 100 back to the disc cartridge 302 again, just the stopper member 33 needs to be turned to its original position. Thus, the disc can be removed from the disc cartridge more easily.

[0083] In the first and second preferred embodiments described above, the stopper member turns within a plane that is defined substantially parallel to the disc. However, the same effects are also achieved even if a structure in which the stopper member turns within a plane substantially perpendicular to the disc or a structure in which the stopper member slides within a plane substantially parallel to the disc is adopted. Furthermore, the same effects are also achievable even if the stopper member is attachable and removable to/from the cartridge body.

[0084] Also, the stopper member and the rotational member interlock with each other in the first preferred embodiment and the stopper member, rotational member and locking member interlock together in the second preferred embodiment. However, the structures of interlocking these members are not

limited to those described for these preferred embodiments. Alternatively, a known interlocking structure for interlocking either the stopper member and the rotational member or the rotational member and a sliding member may be adopted as well.

[0085] Also, in the first and second embodiments described above, the size of the disc **100** is not particularly specified. However, the present invention may be implemented as a disc cartridge for housing a disc having a size of 12 cm or any of various other sizes.

[0086] Furthermore, in the first and second embodiments described above, the disc cartridge is illustrated as having an outer dimension that is slightly greater than the size of the disc. However, the size relationship between the disc and the disc cartridge is not limited to the illustrated one. For example, even when the disc cartridge has an outer dimension that is large enough to store a 12 cm disc therein, the disc storage portion and the disc holding portions of the disc cartridge may have their sizes and structures designed in such a manner as to store an 8 cm disc. Such a disc



cartridge may be used as an adapter for getting read and write operations performed on an 8 cm disc by a disc drive for reading or writing information on/from a 12 cm disc.

#### **INDUSTRIAL APPLICABILITY**

[0087] A disc cartridge according to the present invention can be used effectively as a disc cartridge that is designed to open and close shutters by rotating a rotational member so as to be compliant with any of various standards. The present invention is applicable for use in not just disc cartridges for optical disks but also disc cartridges for other storage types of discs such as magnetic disks and magneto-optical disks.

#### **BRIEF DESCRIPTION OF DRAWINGS**

[0088]

FIG. 1 is an exploded perspective view illustrating the structure of a disc cartridge according to a first preferred embodiment of the present invention.

FIG. 2 is a perspective view illustrating the structure

of the removal history hole and its surrounding portion of the disc cartridge shown in FIG. 1 on a larger scale.

FIG. 3 is a plan view illustrating a state of the disc cartridge shown in FIG. 1 in which the stopper member is closed.

FIG. 4 is a plan view illustrating a state of the disc cartridge shown in FIG. 1 in which the stopper member is opened.

FIG. 5 is a plan view illustrating a state of the disc cartridge shown in FIG. 1 in which the disc is stored and the stopper member is closed.

FIG. 6 is a plan view illustrating a state of the disc cartridge shown in FIG. 1 in which the disc is stored and the stopper member is opened.

FIG. 7 is a plan view illustrating a state of a disc cartridge according to a second preferred embodiment of the present invention in which the disc is stored and the stopper member is closed.

FIG. 8 is a plan view illustrating a state of the disc cartridge of the second preferred embodiment of the present

invention in which the disc is stored and the stopper member is opened.

*Description of the Reference Numerals*

[0089]

11     cartridge lower shell

11m   groove portion

11d   retaining wall

11n   cap member

11k   removal history hole

12     cartridge upper shell

12s   stopper member

12w   disc window

21     first shutter

22     second shutter

21d, 22d, 22c   disc holding portion

23, 33     stopper member

23d   hooking portion

24     locking member

24k   locking end portion

24s unlocking portion

25 rotational member

25k engaging window

25m recess

26 coupling member

26a raised portion

26p pin portion

33 stopper member

33p raised portion

100 disc

100h center hole

301, 302 disc cartridge